# VEER NARMAD SOUTH GUJARAT UNIVERSITY

# PG DIPLOMA IN CAD/CAM/CAE

## Semester-I

| Sr. No. | Subject Code | Subject Name | Scheme | | Marks | |
|---|---|---|---|---|---|---|
| | | | L | P | L | P |
| 1 | CA 101 | Theory of Elasticity and Plasticity. | 3 | 9 | 100 | 150 |
| 2 | CA 102 | Finite Element Analysis. | 3 | | 100 | |
| 3 | CA 103 | Advanced Computer Aided Manufacturing- I. | 3 | | 100 | |
| 4 | CA 104 | Advanced Computer Aided Design. | 3 | | 100 | |
| 5 | CA 105 | Product Design and Development. | 3 | | 100 | |
| 6 | CA 106 | Project | 0 | 3 | 0 | 50 |
| | | **TOTAL** | 15 | 12 | 500 | 200 |

Minimum Marks required for passing is 40% in each theory papers, practical and project separately.

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## Semester-I

## CA 101
## THEORY OF ELASTICITY AND PLASTICITY

- Introduction: Review of force, Moment and stresses, force moment equivalents, static equilibrium, general three dimensional case, dynamic force equilibrium, stress strain relation, principal stresses, different theory of failure.
- Elements of theory of elasticity: Stress tensor, Plane stress and plane strain problems, Equilibrium and compatibility equations in Cartesian co-ordinate system. Air's stress function.
- Torsion: Torsion governing equations, Membrane analogy, analysis of elliptical and rectangular section, Torsion of thin walled hollow shafts of circular, Elliptical and rectangular shape.
- Elements of theory of plasticity: Concepts of true stress and true strain, Uniaxial tension of perfect and imperfect strip, Biaxial tension, Floe rules, Experimental strain analysis, Strain gauges, Rossets etc.
- Elementary analysis of creep and thermal stresses. Creep phenomenon, Creep parameters, Stress relaxation, Designing component subjected to creep.

**Books**

1. Advanced strength of material
   - R.C.Patel
   C.Jamnadas & co.
2. Mechanical Analysis and Design
   - Arthun H. Barr.
   Prentice-Hall of India.
3. Mechanical Engineering Design
   -Joseph E. Shiglay.
   Tata McGraw Hill.
4. Theory of Plasticity
   -J. L. Duncan.

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### CA 102
### FINITE ELEMENT ANALYSIS

- Introduction to Finite Element Method (FEM): General applicability, Engineering applications, General description of FEM, Comparison of FEM with other methods of analysis, General procedure of FEM, Potential energy and equilibrium, The Relay-Ritz Method, The galerkin's approach.

- One Dimensional Finite Element Analysis (Linear Structural Problem) : Finite Element Modelling of one dimensional problem, Natural co-ordinate system and shape function, stiffness matrix and force terms, Elimination approach, Penalty approach, Multipoint constrains, Quadratic shape function, Temperature effect.

- Two Dimensional Finite Element Analysis (Linear Structural Problem) : Finite Element Analysis of two dimension problem, Constant strain triangles, Isoperimetric relationships, Stiffness matrix, Force term, Stress calculation.

- Finite Element Analysis ( Thermal problem) : Finite Element Modelling of steady state thermal problem, Consideration of conduction and convection heat transfer terms, Solution of one dimension problem(fins), Solution of two dimensional problem. Solution of axisymmetric steady state heat transfer problems.

**Books**

1. The Finite Element Method in Engineering.
   -S.S.Rao.
   B.H.Publication.

2. Introduction to Finite Elements in Engineering.
   -Tirupathi R. Chandrupthla & Ashok D. Belegundu.
   Prentice-Hall India Private Limited.
3. The Finite Element Method
   -Zeinkiewiz O.C.
   Tata McGraw Hill Publication.
4. Applied Finite Element Method.
   -Segerlind L.J.
   John Wiley Publication.

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## Semester-I

### CA 103

### ADVANCED COMPUTER AIDED MANUFACTURIND -I

- CNC Machines : Development of CNC Machines, Principles, Features, Advantages, Economics benefits, CNC and DNC concepts, Classification of CNC machines, CNC controllers, Interpolations. Structure of CNC machine tool, Friction, Antifriction and other types of guide ways, Element used to convert rotary motion to linear motion, Screw and nut, Reticulating ball screw, Planetary roller screw, Re-circulating roller screw, Rack and pinion etc. Drives and controllers, Spindle drives, DC shunt motors, 3 phase AC induction motors, Steeper motor, Servo principal, Axis measuring system, Sync resolver.
- Tooling and Maintenance of CNC Machine: Cutting tool materials, carbide insets classification, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, maintenance of CNC Machines.
- CNC programming: Introduction to Various CNC part programming techniques, Co-ordinate system, Structure of part programming, Preparatory commands, Miscellaneous Functions, Spindle control, Feed rate control, Tool function, Tool compensation, Linear and circular interpolation, Plane selection, Part Programme for Face milling, Peripheral milling, Turning and Boring operations, Part programming for different control system, G & M code, APT part programming for various machine.
- Introduction to environment of CAM and their process and modelling overview, Tool path generation and tool path planning using Cam Software, Concept of 3-axis, 4-axis, 5-axis CNC machine and their part programming.
- Special types of CNC machines: CNC grinding machine, EDM, Wire EDM, punch press and their part programming using various CAM packages.

**Books:**


1. HMT- Mechatronics, Tata $M_c$Graw-Hill publishing company limited New Delhi.
2. CNC machining handbook, -James Madison, Industrial Press Inc.
3. Introduction to computer numerical control, - Bery Leathan-Jones, Pitman, London.
4. Computer Numerical Control, - Hans B. Kief , T. Fredericxwaters $M_c$Graw Hill, New Delhi.
5. Manuals of UGCAM and MASTERCAM

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### CA 104
### ADVANCED COMPUTER AIDED DESIGN

- Introduction: Application of computers to design, benefits of CAD, conventional design v$_{s.}$ CAD. Standards in CAD, Graphics and computing standards, data exchange standards, design database interfacing design and drafting, Mechanical assembly.
- Introduction to CAD software: Capabilities of various commercially available software in the area of CAD such as IDEAS, Solid Edge etc.
- Solid modelling: Solid modelling, Rapid prototyping, Data exchange, Documentation, Customizing, Solid modelling systems.
- Rapid prototyping: Rapid prototyping systems, Selective laser sintering - Working principles - Advantages and limitations - Sterolithography - Working principle Applications, advantages and limitations - Case studies.
- Other systems, laminated object modelling - Waving principles, applications - Advantages and limitations - Fused deposition modelling - Direct shell production casting - Applications.
- Re-engineering tools and Implementation: Analytical and process tools and techniques - Information and communication technology - Enabling role of IT, RE-opportunities, process redesign - cases. Software methods in BPR - specification of BP, case study - Order, processing, user interfaces, maintainability and reusability. Introduction to Product Lifecycle Management (PLM) - Concept, Implementation, Case Study.
- **Books**


1. CAD/CAM Theory and Practise,
   -Ibrahim Zeid.
   Tata M$_c$Graw-Hill publishing company limited New Delhi.
2. CAD/CAM principles,
   -P.N.Rao.
   Tata M$_c$Graw-Hill publishing company limited New Delhi.
3. CAD/CAM,
   -Sadhusingh.

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## Semester-I

### CA 105
### PRODUCT DESIGN AND DEVELOPMENT

- Introduction: Nature and scope of product engineering, creative thinking and organizing for product innovation criteria for product success in life cycle of product success in life cycle of a product.
- Modelling and simulation: Modelling and simulation- the roll of models in product design mathematical modelling.
- Design considerations for: Dies for bulk metal deformation- wire drawing, extrusion, forging and rolling, design of dies for sheet metal: Blanking and piercing, Bending and deep-drawing, design of dies for casting and moulding using CAD packages.
- Tolerance and analysis: Dimensioning and tolerancing a product- functional production and inspection datum-tolerance analysis.
- Material selection: Material selection, Problems of material selection, Performance characteristics of materials, the material selection process, Economics of materials, cost verses performance relations, weighted property index.

**Books**


6. Design Methods.
   -J.C.Jons.
   Interscience.
7. Creative Engineering Design.
   -H.R.Buhl.
   Lown State University Press.
8. Engineering Design.
   -G.E.Dieter.
   McGraw-Hill Publications.
9. Tolerance Control in Design and Manufacturing.
   -O.R.Wade.
   Industrial Press.